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MARCH 20, 1939

VOLUME 28 NUMBER 6

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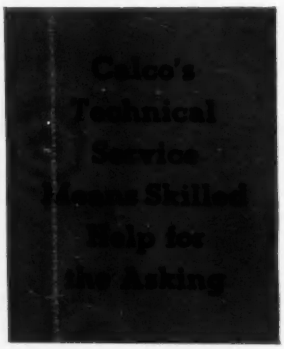

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REVISION OF FASTNESS STANDARDS AND TEST METHODS

IN the 1939 Year Book, which is in preparation at the present time, an endeavor is to be made to revise, as far as is thought desirable, our Fastness Standards and Test Methods.

In order to aid the various committees, who are undertaking this revision, all members are requested to make any criticisms of the present methods as published in the 1938 Year Book, together with suggestions as to how they may be improved. The time to do this is right away, if it is to be of value in connection with the coming Year Book. Please send all such criticisms and suggestions to Louis A. Olney, Chairman of the Year Book Committee of the A.A.T.C.C., care of the Lowell Textile Institute, Lowell, Massachusetts.

STANDARDS FOR FASTNESS TO PERSPIRATION

SUGGESTIONS have been made that a simpler and less severe perspiration test is desirable.

A study is being made of our present Perspiration Test, with the object in mind of revision, and possibly the introduction of a secondary test method.

Any firms or individuals who are interested in Perspiration Tests and Standards, are requested to forward their views to Mr. Hugh Christison, Arlington Mills, Lawrence, Massachusetts, immediately.

Technical Evaluation of

Finishing Treatments

E. R. SCHWARZ, F.T.I.*

INTRODUCTION

FABRICS as they come from the loom are seldom in a state suitable for use or of such appearance or feel as to be pleasing to the ultimate consumer. For this reason, finishing treatments of greater or less complexity must be employed in order to produce satisfactory material. Just when in the sequence of finishing operations a satisfactory finish is obtained is therefore an important decision and rests now largely on the judgment of one or more individuals rather than upon scientific measurement or combinations of the two.

It has been stated by Binns** that the advantage of judgment in certain circumstances lies in the fact that the central organ of mind and the senses are able to correlate automatically the numerous factors of a fluctuating situation and to do it with an accuracy not readily obtainable by scientific methods. One difficulty with judgment in the absence of technical data is the diversity of descriptive terminology employed. For example, consider this instance. As a result of certain visual and tactile tests on a series of worsted fabrics, the judges employed the terms: smart, level, clear, well-covered, even, smooth, bright, homogeneous, compact, well-rounded, balanced, "rawky," rough, irregular, streaky, "grins," knoppy, crepey, rubbed-up, clumsy, cockly, thin, flannely, solid, sharp, stripey, evenly-balanced, and lustrous, to report visual findings. The same group used the terms: silky, soft, full, kind, firm, pliable, tight, solid, well-bedded, mellow, velvety, rich, elastic, sticky, loose, springy, lofty, boardy, weighty, foody, warm, tapery, drapes well, cottony, lumpy, dead, and leathery, to describe their tactile impressions.

If "handle" of a cloth is to be described in any such erratic fashion, there would definitely appear to be room for experimental investigation of what may turn out to be correlated scientific measurements.

The following paper on the "Technical Evaluation of Finishing Treatments" is the first of a series by Professor E. R. Schwarz. These are being jointly sponsored through a cooperative research agreement between the Massachusetts Institute of Technology and the American Association of Textile Chemists and Colorists, for which the Textile Chemists are providing the funds, so that the Institute can assign some of their personnel and equipment to this problem. We note an increasing interest in the subject from both textile producers and textile consumers. A general idea of the scope of the work and a more specific approach to the question of stiffness in fabrics is discussed here, toegther with a bibliography covering important work by others in this field.

K. H. BARNARD, *Chairman*,
Sub-Committee on Permanent Finishes.

HANDLE

A property common to fiber, yarn, and fabric alike is known familiarly in the textile trade as "handle" or "hand." This property is judged as a function of the *feel* of the material and the sensation, of stiffness or limpness, hardness or softness, and roughness or smoothness, all contribute. Physical tests which would analyze and reflect the sensations felt and which would assign numerical values to these measurements are very desirable. Peirce[12] in an article entitled "The 'Handle' of Cloth as a Measurable Quantity" discusses various tests for determining the stiffness factor of fabrics and of yarns. Reference will be made in further detail to this work in the following considerations.

Flexibility—Ease with which a specimen may be bent or twisted can be stated as the *flexibility* of the material. This is to be distinguished from *rigidity*, which is a measure of the resistance offered by the sample to bending or to twisting. In the former case it is known as flexural rigidity and in the latter as torsional rigidity. The rigidity, when related to the resistance to bending, is a measure of the stiffness. Whether we consider flexibility or rigidity in bending or in twisting, there are two approaches to the problem. The first is concerned with measurements of deformation and the second with measurements of the forces producing the deformations. Thus, all tests of these factors may be grouped into two large classes depending upon whether deformation is measured or whether force is measured. It is also possible to classify the tests in the first group by noting the axis of deformation. Specimens may be bent about a horizontal axis or about a vertical axis. They may also be twisted about a central axis or about an axis which does not coincide with the center line of the specimen itself. This latter instance takes place in the twisting of fibers into yarns or of single yarns into plied construction, while the former instance is noted in the twisting of individual filaments as they are placed in yarns—particularly when they are long enough so that the

* Professor of Textile Technology—In charge: Textile Research, M. I. T.

** Binns, H.—"Psychological Investigations of Certain Worsted Fabrics." Jl. Tex. Inst., XXV, No. 3, Mar., 1934, p. T89.

twist insertion or removal in the yarn itself has full opportunity to act upon the individual filament, as in the case of rayon or silk.

In connection with any of the investigations of bending, it is necessary to take into account the weight of the specimen itself or else to so design the test method as to correct for or eliminate the weight of the specimen. It is possible, then, to determine the deformations which take place in a specimen which is allowed to deform with no forces other than its own weight acting or to apply definite forces to produce a deformation and measure both.

MEASUREMENT OF DEFORMATION

Bending about a Horizontal Axis.—Four types of tests may be distinguished as falling under this heading: (1) the cantilever test in which a specimen is supported in an initially horizontal position at one end only; (2) the hanging strip test in which the specimen is supported at one end only and hangs vertically; (3) the ordinary beam test in which the specimen is supported in an initially horizontal position at both ends; (4) the hanging loop test in which the specimen is distorted into any one of several shapes of loop, supported at one point and hanging vertically.

(1)—The empirical study of the cantilever test in many of its ramifications is covered in a paper by Peirce[12] and in its theoretical mathematical implications in a paper by Bickley[5]. For the purpose of mathematical discussion, the specimen is assumed to be a uniform thin lamina in which the curvature is proportional to the bending moment. If the bending moment and the weight per unit area are known, the immediate object of the test is to evaluate the ratio between these two qualities in terms of the overhanging length of the specimen and the angular deflection of the end of the strip. Experiments with specimens of various shapes including the rectangle, triangle, and semicircle, lead to rational formulas in terms of the bending length, so-called. This is the length of fabric which will bend of its own weight to a definite extent.

For the rectangular cantilever, the formula for bending length is

$$C = l\ (\cos 0.5\ \Theta/8 \tan \Theta)^{1/3}$$

For the triangular cantilever,

$$C = l\ (0.6933)\ (\cos o.5\ \Theta/8 \tan \Theta)^{1/3}$$

For the semi-circular cantilever,

$$C = l\ (\cos 0.5\ \Theta/8 \tan \Theta)^{1/3} \left[\left[f\left(\frac{1}{r}\right)\right]\right]$$

where "r" is the radius of the specimen.

In each case values of $(\cos 0.5\ \Theta/8 \tan \Theta)^{1/3}$ are conveniently available in tabular form, as are the values of $f\left(\frac{1}{r}\right)$. This latter function is a complicated trigonometric relationship, involving the cos. Ω which equals

$$\left(1 - \frac{1}{r}\right)$$

The rectangular shape is of wide application, but for extremely flexible fabrics the triangular shape (point outermost) is more satisfactory. One difficulty with the method as a whole is the fact that certain specimens show decided tendency to curl. In this case, the trouble may be minimized by the use of the semi-circular specimen. On the other hand, certain fabrics are stiffer than can conveniently be handled by any of the methods described. In this case, it is possible to weight the end of the specimen and to alter the formula to take this loading into account. The expression becomes more complex, but is not too difficult if a simple modification is made by the justified assumption that one of the ratios involved is substantially constant at 20. Thus, if W is taken to represent the weight added to the end of the cantilever, and b = width of sample, we have:

$$c = l(\cos \Theta/\tan \Theta)\ (0.336\ W/bl + 0.131)^{1/3}$$

Given the stiffness in warpwise and fillingwise directions, it is possible to compute the stiffness in any desired direction. Here

$$c = c_1,\ (\cos.^2 \propto + k^2 \sin^2 \propto)^{-2/3}$$

where $k = (c_1/c_2)^{3/4}$

and the mean value is given with a good degree of precision by

$$\overline{c} = \sqrt{c_1 \cdot c_2}$$

Peirce[12] further points out additional measurements which contribute to a knowledge of "handle." He lists the *flexural rigidity* which is a measure of the resistance to bending and indicates something of the sensation experience when a piece of fabric is bent between the fingers. It may be evaluated as the product of the weight per unit area of the fabric and the cube of the bending length.

Thickness must also be determined and the approved method in this country is that developed at the Bureau of Standards by Schiefer*. The *bending modulus* is valuable since it differs from rigidity in being independent of the dimensions of the specimen. For textiles, it may be considered as a measure of compactness and varies with the degree of adhesion of fibers and yarns. It is most conveniently computed by correcting the rigidity for thickness as,

$$q = 12\ G/d^3\ (10^6)\ \text{kgm/cm}^3$$

Still another modulus is the *modulus of compression*, h. This is also a measure of the hardness of the material in a direction at right angles to the surface,

$$h = (P_1 - P_2)/(d_1 - d_2)$$

Hardness measured by the modulus of compression is therefore the difference in thicknesses existing respectively under each pressure. Two remaining measures are *density* (weight per square centimeter divided by the thickness in centimeters) and the *extensibility* (obtained from the usual tensile test by the strip method).

Just how these various quantities should be combined to

* Schiefer, H. F.—The Compressometer—Bur. Stds. Jl. Res., June, 1933, p. 705.

give a value which will correlate with the judgment of the appraiser using unaided hand and eye is yet to be determined. It is hoped that the present investigation may assist in solving this problem.

The cantilever test requires apparatus which takes the form of a clamp supported in trunnion bearings so that the axis of bending is in the plane of the front edges of the clamp. A platform (often equipped with a pointer), graduated along its length with a convenient scale, is similarly pivoted about the same axis. Thus, the angular deflection of the end of the cantilever can be measured by noting the position of the platform (or pointer) on a curved scale graduated in degrees.

(2)—Of considerable interest and importance is the measurement of flexibility (bending length) which can be obtained according to Peirce[12] from a study of the dimensions of a distorted loop. This is the *hanging loop* technique. A specimen of known width and length (L) is formed into a heart-shaped or pear-shaped loop and suspended from a horizontal bar. Using any desired measuring device ranging from a simple scale to a cathetometer, the distance from the point of suspension to the bottom of the loop may be measured. The bending length formulas are—

$c = l_0 f_2 \Theta$ for the heart loop

$c = L(0.133)\ (f_2\Theta)/\cos.\ 0.87\Theta$ for the pear loop

where

$l_0 = 0.1337L$ heart loop

$l_0 = 0.4243L$ pear loop

and $d = l\text{-}l_0$

$\Theta = 32.83^d/l_0$ heart loop

$\Theta = 504.5\ ^d/l_0$ pear loop

(3)—Hall[10] suggests placing a specimen horizontally on a smooth surface such as glass, against a co-ordinate ruled background. The specimen is then formed into a self-supporting inverted "U" shaped arch which can be measured against the co-ordinates. In the same manner Grimshaw[7] suggests that stiffness of fabrics might be measured by determining the comparative sag of samples held between jaws horizontally and pulled out to various lengths.

(4)—Smith-Taber[28, 29] has developed an instrument for measuring the stiffness of materials including fabrics which supports the specimen vertically by means of a clamp at the upper end. The clamp is arranged in conjunction with a graduated disk so that indicator mechanisms provide a signal as soon as the specimen has bent through a standard angle of 22.5 degrees, and the amount of rotation of the disk can be measured to indicate relative stiffness.

BENDING ABOUT A VERTICAL AXIS

A test for bending deformation about a vertical axis is a drape tester designed by Bellinson at the M. I. T. Textile Research Laboratory. In this device a fabric specimen of desired length and width is suspended vertically with its upper edge secured closely in contact with the periphery of a horizontal disk of semi-circumference equal to the width of the specimen. The disk is adjustable as to height of support so that the bottom edge of the specimen just grazes the surface of a base on which is drawn a circle of diameter equal to the diameter of the disk and concentric with it. Tangent to the circle is drawn a straight line and two perpendiculars are erected to this line which are also tangent to the circle. If the fabric is entirely flexible and uniformly so, the bottom edge of the specimen will form a semi-circle matching one-half of the base circle. The stiffer the fabric, the more nearly the bottom edge will approach a straight line. When the fabric falls between these two forms, the intercept of the edge with the vertical tangents is noted. The distance from the base line to the intercept is divided by the length of the respective tangent measured from the base line to the point of tangency with the circle. Another method of using the device in the case of a stiff fabric is to shorten the length of the specimen progressively until the lower edge shows a definite degree of departure from a straight line. The length of sample is then an inverse measure of the stiffness.

MEASUREMENT OF DEFORMING FORCE

The second classification of flexibility tests is concerned with the measurement of force rather than deformation.

Bending About a Horizontal Axis—(1) The first type to be treated is the *cantilever*. The specimen may take the shape of a flat strip or a loop and is held at one end in a rotatable clamp, the degree of rotation of which can be read on a scale. The other end is allowed to rest on one pan of a balance. If now the specimen is pressed against the balance pan by rotating the clamp, the force necessary to restore the unclamped end to its original position is measured. Such a device is described by Saxl[23]. Durst[6] describes a somewhat similar scheme, except that the specimen is clamped at one end, bent into a "U" shaped spring and allowed to press against a balance pan.

(2) Vertical strips and loops can be tested in a device developed by Gurley[9]. Here the specimen is clamped at its upper end to a rotating arm, and is drawn across the edge of a horizontally pivoted vane. The deflection of the vane can be measured at the instant that the specimen slips off it. As modified in the Textile Research Laboratory at M. I. T., the clamping arm moves against a scale allowing the angular displacement of the upper end of the specimen to be measured as well. If certain known weights are placed at specified points on the vane support, the angular displacement of the van can be converted to milligrams force necessary to produce the deflection by reference to a table.

(3) Munzinger[11] advocates the use of a modified ballistic pendulum. In this device the specimen is supported at its lower end and extends up vertically into the path of a swinging pendulum. The distance which the pendulum swings beyond its lowest point without a specimen in place is compared with the distance it swings after bending the specimen in the course of its passage.

The difference in energy was absorbed by the specimen in bending and is a measure of stiffness.

Bending About a Vertical Axis—(1) When bending takes place about a vertical axis, it is usual to support both ends of the specimen if the deforming force is to be measured. An instrument designed in this manner was developed by Schiefer[24] and embodies the unique feature of testing two samples in opposition. Each specimen is rectangular in shape and is supported at one end by cementing to a clip which can be attached to the outer edge of a movable vane. The other end is similarly attached to the outer end of a fixed vane. The rotating vanes are attached at their inner edges to a vertical, central axis. Two vanes are fixed against rotation, while two are rotatable in such fashion as to fold the specimens between themselves and the fixed radial vanes. A pointer reading against a circular scale gives the angular rotation of the vanes. Rotation is brought about by means of either a cantilever or a spiral spring, the deflection of which is readable on a second circular scale. Provision is made for calibration of the spring by means of dead weights, and after calibration, the stress acting to deform the specimens is read from a table or chart. Both folding and unfolding can be carried out in as many cycles as desired so that hysteresis effects can be investigated conveniently. The energy required to fold a sample of fabric is a measure of its stiffness and the recoverable energy expressed as a percentage of the energy input is a measure of its resilience. The energy which is lost when a sample is folded is dissipated in producing a crease in the fabric. The angle to which the fabric is folded and the time it is allowed to remain folded, as well as the dimensions of the sample are important factors. In order to obtain comparable results the angle to which the sample must be folded as a limit depends upon the thickness of the specimen. An equation for determining the minimum angle for any given thickness of fabric is given as

$$\beta = 430d$$

where β is angle in degrees and d is thickness of sample in inches.

(2) Torsion pendulums may also be employed for measuring the forces necessary to bend a fabric about a vertical axis. Here two pendulums are arranged to hold both ends of a rectangular strip of fabric. Each pendulum is suspended by a long, fine filament, and is of known moment of inertia. These moments are substantially equal for the pendulums as is the period of oscillation in torsion when unrestrained. If now a specimen is supported between the pendulums and they are started in rotation in opposite directions, the period of oscillation will be a function of the flexural rigidity.

$$\text{Flexural rigidity} = 2\pi^2 I_p \left(\frac{1}{T^2} \right)$$

$$= f\left(\frac{1}{T^2} \right)$$

So that if the reciprocal of the square of the average period for one sample is compared with a similar quantity for another sample (pendulum system and size of specimen remaining constant throughout), the flexural rigidities will be in similar relationship. This method has been used by Peirce[13] to test starch films and is probably adaptable to fabric as well.

FACTORS CAUSING VARIATIONS

In carrying out flexibility tests, two sets of factors which cause variation in results must be considered. One set is made up of external conditions and includes moisture regain, rate of load application or rate of deformation, and curvature or distortion of the specimen in mounting. Moisture regain has a very decided influence upon the results of test by any method and it has been found that regardless of the kind of fiber composing the material tested, an increase of moisture regain produces an increase in flexibility. It may eventually be possible to establish correction data so that flexibility measured under any existing moisture condition can be corrected to any other desired or standard condition. Whether the standard condition should be one of substantial equilibrium with a standard atmosphere, or whether it should be worked out on the basis of a constant moisture regain is a matter for eventual decision.

All textile materials are essentially plastic in their properties of deformation, hence the time rate of loading or deforming must be carefully studied and controlled. Not only the conditions during the actual tests should be under control, but the rest periods both as to duration and as to location in the cycles of tests must be carefully worked out. There is evidence to point to the likelihood that fibers obey some form of "memory law," such that for a certain time after a distortion, they remember the distortion and during this time further distortions will be affected by the previous treatment. Unless great care is exercised, it is obvious that results may be erroneously interpreted or be impossible of interpretation.

Results of flexibility tests may be seriously affected by distortion of the specimen in setting it up in the instrument used. This may be demonstrated readily by holding a sheet of paper horizontally between the fingers, grasping it at one end. If the end which is held is straight, the paper will droop into a characteristic flexing curve. If, however, the edge held in the fingers is curved even the slightest amount, the flexing curve is considerably altered. By producing a sufficient degree of curvature of the supported edge of the paper, it will be found that no flexing will occur in the sheet under its own weight, and that furthermore, a considerable pressure must be exerted to cause deflection.

The factors are also to be considered which are inherent to the specimen itself. Finish, thickness, weight, yarn waviness, fiber composition, skewed yarns, and bow all contribute variable amounts to the difficulty of a precise measurement. If the result of finishing operations is to be

investigated, as is proposed in this work, it is obvious that all the other items of internal variation must be controlled, eliminated, or corrected for.

LITERATURE REVIEW

For the purpose of additional background in this project it is proposed to survey the methods now in use in the paper industry for the measurement of stiffness of paper, and to review the published material relating to the exercise of judgment through the sense of touch in grading fabrics as to quality. The results of these surveys will be published shortly.

EXPERIMENTAL

For the experimental work a fabric which has been finished by a routine which has produced a satisfactory material will be compared with the unfinished fabric by the hanging loop technique, the cantilever test, the Gurley Vane test, the Schiefer Flexometer test, the Bellinson drape test, the Searle pendulum test and the Munzinger Impact test. Additional fabrics will be subjected to a similar series of investigations, the materials selected in each case to furnish a reasonable range of thickness, stiffness and weight. It is also hoped that a series of tests may be arranged to grade a range of fabrics manually for flexibility and for handle in general, and to initiate a program, the object of which will be to establish any correlation between the manual and the technical tests which may be discovered.

Work is already underway on the test methods noted above with the exception of the last two. These instruments are under design and will be constructed and employed as soon as possible. Work is conducted in a constant temperature and humidity laboratory and advice from a staff member specializing in the field of textile plasticity is available in connection with details of procedure. Adequate statistical analysis of data, and precision planning of experiments and sampling will be employed throughout.

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The Effect of Surface Active Agents in Dyeing*

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INTRODUCTION

An important development in textile processing during the past few years has been the increasing use of a class of synthetic organic chemicals known as surface active agents as assistants in the dye bath to promote penetration and uniform or level dyeing. Representative types of the new materials are the salts of alkyl naphthalene sulfonic acids, sulfated fatty alcohols, high molecular long-chain sulfonic acids, sulfonated oils, and quaternary ammonium compounds. The sodium and potassium salts of fatty acids, commonly known as soap, are the oldest known surface active agents, but they cannot be adapted for use in many processes and have been displaced in others by the recently developed products which are better suited.

The results obtained with surface active agents are primarily due to certain physical chemical properties these materials have in solution. They have the valuable property of lowering the interfacial tension of water and of solutions in water toward gases, liquids and solids. The surface active agents frequently act effectively to disperse a wide variety of materials including fats, oils, waxes, precipitated soaps, and pigments. Solutions of surface active agents displace air from textile fibers much more readily than does water. As a result of these properties, surface active agents produce rapid wetting of textile fibers even though the fibers may be contaminated with natural waxes, fats, and gums.

The uses of surface active materials in dyeing processes have been determined largely by the method of trial and error. A large fund of experience has been accumulated on the basis of practical trials. Although many profitable applications of surface active materials in dyeing processes are well known, the mechanism by which surface active agents act to accomplish penetration and level dyeing has not been studied extensively. Boxser[1] concluded that the lowering of the surface tension of the dyebath is the chief influence of penetrants. Jacoby[6] found that Nekal BX, an alkyl naphthalene sulfonic acid salt, increases the solubility of benzopurpurine 4B at 20° C., but decreases the solubility markedly at 80° C. Schramek and Velten[15] found that Nekal BX acts as a protective colloid for suspensions of Indanthrene colors. Dhingra, Uppal, and Venkataraman[2] found that wetting intensity and protective colloid action are unrelated for many surface active agents. Valkó[17] found that a number of high molecular alkyl sulfonic acid salts have very little effect on the aggregation of a number of dyes for cotton and wool in salt solutions.

There is a popular conception that surface active agents act as leveling agents in the dyebath by a dispersing action on the dyes. However, there is no evidence in the literature to support this point of view. In view of the known practical value of surface active agents as additions to the dyebath, it appeared advantageous to study more completely their function in the dyeing process to determine if still further advances could be made in this field. The experimental work to be described in this paper is limited to observations of the effect of surface active agents on the dispersion of dyes in the dyeing of cotton and in their removal from cotton.

Before proceeding further with our discussion, it should be of interest to consider the basis for the idea that a dispersing agent for dyes would be of value in the dyebath.

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Ever since the observation that dyes exhibit colloidal properties in solution, a great deal of importance has been attached to the influence of particle size on their dyeing properties, especially in the dyeing of cotton and rayon. The cotton fibers, as well as regenerated cellulose fibers, are quite porous structures. The larger pores of the fibers are easily visible under the microscope. The walls of these microscopic pores are in turn divided by a network of smaller channels that are not visible under the microscope but which have been identified from X-ray diffraction patterns. Dyeing occurs largely on the surfaces of these submicroscopic pores. It is obvious from the structure of the cotton fiber that the size of the dye particles in the dyebath is of importance, for the dye must at least be finely enough dispersed to enter the small spaces between the cotton micelles. There have been two points of view as to the relationship between particle size and dyeing. The older idea is the so-called mechanical theory of dyeing. This explanation of dyeing is purely a particle size theory and was widely accepted at one time. The advocates of the mechanical theory argued that the porous fiber acts as a seive for the dye particles. According to this theory only dye particles which fit into the pores and are large enough to become trapped are held. The addition of salt to the dyebath was believed to adjust the particle size of the dye to the optimum condition required for absorption. While the mechanical theory of dyeing is still cited occasionally, a more widely accepted theory today is that the cotton removes the dye from the bath by a process of adsorption. However, the particle size of the dye in the bath is still of great importance for it is obvious that these small dye particles must be able to penetrate into the small channels of the cellulose fiber before dyeing can occur. Work reported by Schaeffer[14], Rose[12], and Lenher and Smith[10] shows that dyebaths containing dye particles with an average radius larger than 18Å to 25Å do not dye cotton as rapidly as do dyebaths containing smaller dye particles. Thus we see that regardless of the explanation we accept for the phenomenon of dyeing, the degree of dispersion of the dye in the bath is of great practical importance if a good result is to be obtained.

A considerable amount of quantitative work has been published during the past few years on the factors influencing the growth and dispersion of dye micelles or particles in water solution. A survey of the published data leads us to believe that most highly purified water soluble dyes dissolve in water as very small particles scarcely larger than a molecule. In fact many dyes appear to dissolve to give simple unassociated color ions and sodium ions in the bath. It is only on the addition of an inorganic salt, as for example common salt, that the pronounced colloidal properties that we associate with dyes are observed. These dye particles are best thought of as clusters of loosely held dye ions. Their formation is easily influenced by the salt content and temperature of the solution. The addition of as little as a 0.5 gram per liter of sodium chloride is sufficient to cause may dyes to build up larger particles in the bath. If sufficient of the salt is added, the dye is precipitated from solution. The effect of sodium chloride and sodium sulfate in causing agglomeration of dye ions to build the larger dye micelles is most pronounced at room temperature. The dye particles built up by adding salt at room temperature are readily dispersed by raising the temperature of the solution. Most dyes are not extensively aggregated in solutions near the boil in the presence of the amounts of common salt or Glauber's salt normally used during dyeing. It appears that the particles of substantive dyes for cotton have a radius under 10Å in solutions near the boil in the presence of the amounts of common salt or Glauber's salt normally used during dyeing. In fact a number of substantive dyes appear to approach closely to the molecular size in the dyebath at the boil. It is apparent that the radius of these dye particles is much smaller in the dyebath than the maximum permissible radius of 18Å for rapid penetration into the fine pore structure. Data of Valkó[17] show that representative vat colors are also only slightly aggregated in the dyebath. It appears unlikely that a dispersing agent for the commercially used dyes is required in the dyebath to promote penetration of the dyes into the fine pore structure of textile fibers. However, since the possibility remained that surface active agents act to disperse the small dye particles into dye ions in the dyebath, considerable experimental work was carried out to determine whether these materials have a dispersing action on dye micelles.

The effect of surface active agents on the degree of dispersion of dyes in the dyebath cannot be determined by direct observation. The dye aggregates with which we are concerned are much too small to be visible with the microscope. The best method for an estimation of the particle size of dyes in solution is by means of diffusion experiments. The rate of diffusion of the dye particles is directly related to their size in solution.

DIFFUSION EXPERIMENTS

The effect of technical lauryl sodium sulfate, representative of anionic surface active agents, on the degree of dispersion of benzopurpurine 4B (C. I. 448) in solutions containing sodium chloride was estimated from diffusion measurements. Benzopurpurine 4B is a typical substantive color for cotton that has been found by many workers to show pronounced colloidal properties in aqueous solutions. This dye is readily agglomerated in solution by inorganic salts; the effect of dispersing agents as well as protective colloids might be expected to be most pronounced with a color of this colloidal type.

The benzopurpurine 4B used in these experiments was purified by the method of Rose[13] as described by Lenher and Smith[7]. The technical lauryl sodium sulfate was obtained by the recrystallization of "Gardinol" WA from ethyl alcohol. Since ageing phenomena frequently play

an important role in the behavior of dye solutions, the dye solutions were prepared by two methods: (1) the lauryl sodium sulfate and sodium chloride were added to the dye solution at 25° C. and the solution aged for 18 hours; (2) the lauryl sodium sulfate and sodium chloride were added to the dye solution at 25° C., the solution heated to the boil, then cooled to 25° C. and aged for 18 hours. The diffusion measurements were run by the Fürth[4] microdiffusion method as described by Lenher and Smith[10]. The method depends on the measurement of the rate of free diffusion of the dye from its solution into water in a microdiffusion cell. The progress of the diffusion was observed with a microcomparator calibrated to 0.01 mm. The particle size of the dye in solution was calculated by the Einstein[3] equation.

$$(1)\quad D = \frac{RT}{N} \cdot \frac{1}{6\pi nr}$$

where r = av. radius of micelles, cm.
R = gas constant
T = absolute temperature
D = diffusion constant, sq. cm./sec.
N = Avagadro's number
n = coefficient of viscosity of the solvent.

Hartley and Robinson[5] have shown that equation (1) may be applied for the diffusion of dyes in solution in the presence of relatively large concentrations of inorganic salts. The diffusion constants and the calculated particle radii in the dye solutions are given in Table I.

TABLE I

Effect of Lauryl Sodium Sulfate on the Particle Size of Benzopurpurine 4B (C. I. 448) in Solution

Dye Conc. g./l.	*Lauryl Sodium Sulfate Conc. g./l.*	*Sodium Chloride Conc. N*	*Solution Method*	*T °C.*	*$Dx10^6$ cm. 2/sec.*	*$rx10^8$ cm.*
0.5	—	0.025	(1)	25	1.39	17.35
0.5	1.0	0.025	(1)	25	1.71	14.19
0.5	2.5	0.025	(1)	25	1.28	18.95
0.5	—	0.025	(2)	28	1.42	18.4
0.5	2.5	0.025	(2)	26	1.16	21.4

The data of Table I show that lauryl sodium sulfate at 1.0 gram per liter has a slight dispersing action and at 2.5 grams per liter a slight agglomerating action on benzopurpurine 4B in solution. The effects observed are not believed to be sufficient to be of fundamental importance in the dyeing process.

DYEING EXPERIMENTS

Observations of the effect of surface active agents on the relative dispersion of benzopurpurine 4B in the dyebath were made by dyeing experiments. The method used was based on the widely accepted fact that the particle size of dyes in the bath has a marked effect on the rate of absorption by textile fibers. Data of Lenher and Smith[9] show that the rate of absorption of dyes by cotton is increased by an increase in the sodium chloride concentration as long as the particle radius in the dyebath remains below a critical region of 18Å to 20Å. However, when the particle radius becomes much greater than 18Å to 20Å the rate of dyeing is sharply decreased. For example, it was observed that during an arbitrary period of 1 hour at 25° C., the rate of absorption of benzopurpurine 4B increases with an increase in the salt concentration up to 0.025N and then decreases almost 45 per cent in the presence of 0.05N sodium chloride. From these observations, it appeared advantageous to study the qualitative effect of different surface active agents on the degree of dispersion of benzopurpurine 4B in the dyebath by observations of the effect of these agents on the rate of dyeing at varying sodium chloride concentrations.

The surface active agents used in these experiments were technical lauryl sodium sulfate, "Alkanol" B (the sodium salt of an alkyl naphthalene sulfonic acid) and sodium oleate. The "Alkanol" B was freed of inorganic salts by recrystallization from benzene. The sodium oleate was prepared by adding the calculated quantity of sodium hydroxide to U.S.P. oleic acid. The lauryl sodium sulfate and benzopurpurine 4B were purified as previously described.

Dyeings were made with 75 mg. of the purified benzopurpurine 4B on 10 g. pieces of cotton pongee in 200 cc. of water containing sodium chloride in concentrations varying from 0.01N to 0.08N. The dyebaths were in pint Mason jars which contained ten metal balls. The jars were agitated by rotating in a Launder-Ometer for 1 hour at 25° C. The absorption of dye was judged from an evaluation of the color present in the dyebath with a Keuffel and Esser rotating sector spectrophotometer before and after dyeing. The absorption data are summarized in Table II.

TABLE II

Effect of Surface Active Agents on Absorption of Benzopurpurine 4B (C. I. 448) by Cotton at 25° C

Surface Active Agent	*Conc. g./l.*	*% absoption from dyebath NaCl Conc. N.*							
		0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.0
None		48.0	58.7	58.7	42.7	40.0	37.3	34.0	32.(
Lauryl sodium sulfate	2.5	55.4	61.4	48.0	44.7	42.0	38.7	35.3	26.(
"Alkanol" B	2.5	61.4	61.4	50.0	46.7	42.7	36.0	36.0	28.7
Sodium Oleate	2.5	50.7	55.4	52.0	43.3	40.7	36.0	25.3	

Time = 1 hr. Temp. = 25° C. Dye = 0.075 g. Cotton = 10 g.

TABLE III

Effect of Surface Active Agents on Absorption of "Ponsol" Blue RS (C. I. 1106) by Cotton

Surface Active Agent	*Conc. gi/l.*	*% absorption NaCl Conc. N*								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
None		72.0	81.6	84.4	85.4	85.6	81.0	79.6	69.6	61.0	55.4
Lauryl sodium sulfate	6.25	76.6	82.0	85.0	87.0	90.0	90.6	86.6	76.0	66.0	61.0
"Alkanol" B	6.25	71.0	82.0	83.6	89.0	85.6	87.6	82.6	76.6	68.3	51.4
Sodium Oleate	6.25	76.4	82.6	86.6	86.0	90.0	91.0	84.4	75.0	64.0	54.0

"Ponsol" Blue RS = 0.5 g. Cotton = 10 g.
Temperature = 140° F. Time = 5 min.
Each value in the table is an average of three dyeings.

There is considerable variation in the amount of dye absorbed at the lower concentrations of salt. However, the data show clearly that in the absence of surface active agents, the maximum rate of dyeing is obtained in the presence of 0.03 N sodium chloride while in the presence of the surface active agents, the maximum rate of dyeing occurs at a 0.02N sodium chloride concentration. Unevelness in the dyeings in all of the series was first noted when the dyeing rate decreased. It is concluded that the added surface active agents cause aggregation rather than dispersion of the benzopurpurine 4B in solution. Although the surface active agents tended to agglomerate the dye, the series of dyeings made in their presence were as a whole considerably more level than the dyeings made without the added textile assistants.

The effect of surface active agents in the application of a representative vat color "Ponsol" Blue RS (C. I. 1106) was studied by the general method used with benzopurpurine 4B. In these experiments, dyeings were made for 5 minutes at 140° F., the normal dyeing temperature, on 10 gram skeins of unbleached, unboiled out 40/2 cotton yarn. The dyebaths contained 500 mg. of the standard color and sodium chloride in concentrations up to 0.9N. The dyebaths were contained in porcelain pots and were prepared as follows: the dye paste was slurried in 25 cc. of water, 25 cc. of 10 per cent sodium hydroxide (by volume) were added. The color was reduced at 120° F. by the addition of 2 g. of sodium hydrosulfite ($Na_2S_2O_4$). After 15 minutes the surface active agent was added in solution; the bath was diluted to a 400 cc. volume by the addition of water containing the required amount of sodium chloride. The dyebath was aged at 140° F. for 1 hour.

The cotton skeins were immersed for 15 minutes in boiling water and run between squeeze rolls before entering in the bath. The skeins were turned continuously by hand during the dyeing operation. On removing the skeins from the dyebath, they were run quickly between squeeze rolls, air oxdized, washed in hot water, soured in cold dilute acid, rinsed, and soaped with 0.25 per cent olive oil soap at the boil. The dry dyeings were evaluated for strength against dyeings of known strength. The evaluations for strength were made by a comparison of the reflectance values of the dyeings with the spectrophotometer at a selected wave length.

A summary of the data giving the per cent Blue RS absorbed is given in Table III.

Slight precipitation in the dyebaths occurred in the presence of 0.6N sodium chloride; the precipitation became greater with increasing sodium chloride concentrations both in the presence and absence of the surface active agents.

The data of Table III show that in general an increase in the degree of absorption of dye occurs in the presence of the surface active agents. A decrease in the rate of absorption begins with a 0.5N sodium chloride concentration in the absence of the surface active materials and with a 0.6N sodium chloride concentration in the presence of the surface active agents. Since the rate of absorption changes in much the same way in all of these series of dyeings, it appears unlikely that the surface active materials act as dispersing agents to any large degree in these experiments. The increases in absorption noted in the presence of the wetting agents might easily be due to their action in promoting rapid wetting of the raw cotton by the dye liquor.

EFFECT OF SURFACE ACTIVE AGENTS ON THE DISPERSION OF DYES IN WASHING PROCESSES

The effect of surface active agents on the degree of dispersion of dyes on cotton was studied by means of wash tests. It might be expected that a peptizing action of the detergent on the dyes would be reflected in an increased removal by detergent solutions compared with water. Accordingly a study was made of the effect of olive oil soap, technical lauryl sodium sulfate, and cetyl pyridinium bromide on the removal of a number of representative azo colors of known widely varying washing fastness from cotton.

Dyeings of approximately 1 per cent of "Pontamine" Fast Red 8BNL, "Pontamine" Diazo Red 7BL (direct), "Pontamine" Diazo Red 7BL (developed with beta naphthol), "Pontamine" Diazo Red BFW (direct) and "Pontamine" Diazo Red BFW (developed with beta naphthol) on cotton broadcloth were washed at 50° C. and at 100°

C. Since the pH of detergent baths is known to have a considerable effect in the bleeding of water soluble dyes from cotton, the wash tests were run in water alone and in solutions buffered with 0.02N sodium acid sulfate and with 0.01N sodium chloride, disodium phosphate, sodium carbonate, and trisodium phosphate. Parallel experiments were carried out with the addition of the detergents.

The wash tests at 50° C. were made on 2 g. strips of the dyed cotton submerged in 200 cc. of the detergent solutions contained in pint Mason jars. The detergent solutions were agitated by rotating the jars for 30 minutes in a Launder-Ometer; each jar contained ten metal balls to promote vigorous agitation. The washed dyeings were dried on a mangle. The wash tests were made in duplicate. In each test of the effect of a detergent a parallel run was included omitting the detergent since the agitation was known to vary from test to test. The wash tests at the boil were carried out with 2 g. strips of the dyed cotton submerged in 200 cc. of the detergent solutions; the solutions were contained in 500 cc. round bottom flasks fitted with reflux condensers. The solutions were brought to the boil before entering the goods; the goods were washed for 30 minutes and removed from the boiling bath. The wash tests were run in duplicate. The strength of the dyeings before and after washing were evaluated by means of a spectrophotometer as previously described.

TABLE IV

Wash Fastness of Direct Red 7BL Dyeings at 50° C.

Detergent	*Conc. g./l.*		*Per Cent color removed in three washes*				
			NaCl	*$NaHSO_4$*	*Na_2HPO_4*	*Na_2CO_3*	*Na_3PO_4*
Water		66.6	45.8	32.2		55.2	58.1
Lauryl sodium sulfate	0.25	68.3	46.8	23.9		52.7	53.7
Lauryl sodium sulfate	2.5	49.4	36.4	18.2		34.1	40.9
Cetyl pyridinium bromide	2.5	6.9	5.6	2.3		4.5	5.6
Water		64.4	43.7	16.7		47.9	50.8
Cetyl pyridinium bromide	0.25	10.4	8.3	8.3		18.7	23.9
Water		77.2	58.3		65.5	66.7	69.0
Olive oil soap	1.0	77.7	56.7		63.3	63.8	64.1

Wash Fastness of Direct Red 7BL Dyeings at 100° C.

			Per Cent color removed in one wash				
Water		90.9	75.6	61.1	80.7	82.0	81.6
Lauryl sodium sulfate	0.25	85.7	78.7	57.8		83.1	84.0
Cetyl pyridinium bromide	0.25	20.0	24.9	25.8			Discolored
Olive oil soap	2.5	86.7	77.7		82.6	80.6	83.3

TABLE V

Wash Fastness of Red 8BNL Dyeings at 50° C.

Detergent	*Conc. g./l.*		*Per Cent color removed in three washes*				
			NaCl	*$NaHSO_4$*	*Na_2HPO_4*	*Na_2CO_3*	*Na_3PO_4*
Water		19.3	16.0	4.8		16.0	12.9
Lauryl sodium sulfate	0.25	34.6	15.0	11.2		21.0	17.7
Water		34.5	22.6	8.1		24.2	16.0
Lauryl sodium sulfate	2.5	27.4	11.2	None		5.6	11.2
Water		34.9	27.4	6.3		27.4	37.4
Cetyl pyridinium bromide	0.25	None	None	None		None	None
Water		40.2	18.0		22.1	22.9	26.2
Olive oil soap	1.0	46.7	22.1		27.0	22.9	24.6

Wash Fastness of Red 8BNL Dyeings at 100° C.

Detergent	*Conc. g./l.*		*Per Cent color removed in one wash*				
			NaCl	*$NaHSO_4$*	*Na_2HPO_4*	*Na_2CO_3*	*Na_3PO_4*
Water		81.8	53.4	35.7	63.3	62.5	65.7
Lauryl sodium sulfate	0.25	81.8	54.6	36.6	63.1	64.2	64.1
Cetyl pyridinium bromide	0.25	None	1.7	5.2			Discolored
Olive oil soap	1.0	76.0	59.5		61.7	66.7	64.3

TABLE VI
Wash Fastness of Direct Red BFW at 100° C.

Detergent	Conc. g./l.	Per Cent color removed in one wash				
			NaCl	Na_2HPO_4	Na_2CO_3	Na_3PO_4
Water	....	47.0	21.4	38.4	56.0	50.9
Lauryl sodium sulfate	0.25	50.9	42.3	43.7	52.7	48.2
Olive oil soap	1.0	48.2	39.3	40.2	50.0	45.2

TABLE VII
Wash Fastness of Developed Red 7BL at 100° C.

Detergent	Conc. g./l.	Per Cent color removed by one wash				
			NaCl	Na_2HPO_4	Na_2CO_3	Na_3PO_4
Water	....	48.2	23.3	42.8	35.7	37.5
Lauryl sodium sulfate	0.25	52.3	35.8	47.3	41.0	41.0
Olive oil soap	1.0	61.6	26.7	42.0	42.0	40.2

TABLE VIII
Wash Fastness of Developed Red BFW at 100° C.

Detergent	Conc. g./l.	Per Cent color removed by one wash				
			NaCl	Na_2HPO_4	Na_2CO_3	Na_3PO_4
Water	....	9.9	3.3	5.1	6.6	5.1
Lauryl sodium sulfate	0.25	2.2	6.6	5.5	7.7	7.7
Olive oil soap	1.0	6.7	...	5.1	11.5	14.4

TABLE IX

Detergent	Conc. g./l.	pH of Detergent Solutions				
			NaCl	$NaHSO_4$	Na_2CO_3	Na_3PO_4
Water	....	6.0	5.3	2.2	10.3	10.8
Lauryl sodium sulfate	0.25	10.6	10.5	2.5	10.6	10.9
Cetyl pyridinium bromide	0.25	3.1	3.1	2.1	9.4	10.3
Olive oil soap	1.0	8.9	8.9	...	10.1	10.7

A summary of the data from the wash tests is given in Tables IV to VIII. The pH of the detergent solutions, obtained with a glass electrode is given in Table IX. The detergents used in these tests were technical products and contained up to 5 per cent of sodium chloride and sodium sulfate incidental to the processes of manufacture.

The effect of detergents which give both positively and negatively charged surface active ions in solution on dyes of widely varying fastness is given in these tests. The technical lauryl sodium sulfate and soap give negatively charged surface active ions while the cetyl pyridinium bromide ionizes to give a positively charged surface active ion in aqueous solutions. The detergents were used at concentrations known to exert excellent scouring action. The dyes are all azo colors containing sulfonic acid groups in the molecule; with the exception of Developed Red BFW the dyes are water soluble and ionize in water solution to give negatively charged color ions. The dyes vary in wash fastness from very poor for Direct Red 7BL to exceptionally good with Developed Red BFW. The concentration of added buffer or sodium chloride was held to a minimum in these tests, since the metal ion concentration alone is known to be an important factor in preventing the bleeding of dyes from textile fabrics.

It is noted that water alone in many instances removes as much color from the dyeings of water soluble colors as do any of the detergents. Inorganic salts, even at the low concentrations present in commercial laundering processes, retard the removal fo dye by detergent solutions considerably. The hydrogen ion concentration in the bath is an important factor in the removal of dye; acid solutions retard while alkaline solutions accelerate the removal of color. Detergents which give negatively charged surface active ions tend to increase the removal of the more wash fast colors at low concentrations in solution; at higher concentrations these detergents may retard bleeding of the dye, possibly as a result of the effect of the metal ions obtained in solution on ionization of the detergent. Cetyl pyridinium bromide which gives positively charged surface active ions in solution greatly retards and in many instances practically prevents the removal of the water soluble, substantive dyes from cotton in a detergent bath. The cetyl pyridinium bromide is known to have a strong precipitating action on direct colors and probably acts to restrain bleeding of the dyes as do heavy metal salts. Since the additions of the detergents do not cause any pronounced increase in the removal of the dyes from cotton, it is inferred that the removal of the water soluble

dyes is primarily due to the solubility of the dyestuff in water rather than to any peptizing action from the detergent.

DISCUSSION

The practical value of adding surface active agents in dyeing operations is widely recognized by textile processors. The data of this paper show that the surface active agents do not act to disperse dyes either in the dyebath or on the textile fibers. The greater part of all dyeing is carried out with dyes which give negatively charged color ions in solution. The anionic surface active agents appear to have at most a mild agglomerating effect on the dyes, possibly as an effect of the positively charged metal ions obtained from these surface active agents in solution. The cationic surface active quaternary ammonium compounds have a strong precipitating action on negatively charged dye ions and are used to fix water soluble substantive dyes on cellulose fibers to bleeding in water.

The results of Lenher and Smith[9] show that a number of representative substantive colors are well dispersed in solution at the temperatures used in dyeing; Valko[16] has shown that representative acid colors are in almost molecular solution even at room temperature and that the leuco salt of the vat color, Caledon Jade Green, is only slightly aggregated in the dyebath. It is apparent that the gain from a dispersing agent for the dyes in commercial processes would be negligible. The swelling of textile fibers in contact with water is essential in opening the intermicellar spaces for penetration of dyes; it is probable that the chief function of negatively charged surface active ions in dyeing cellulose materials is in promoting this swelling action by assisting in the uniform and rapid wetting of the fiber surfaces. Since many dyes are absorbed very rapidly by cellulose fibers, it is likely that the rate of wetting and swelling of the fibers is an important point in obtaining uniform dyeing. The positively charged surface active agents are known to retard considerably the rate of dyeing on cellulose materials, and it is probable that these products derive their effectiveness as leveling agents for their action as retardants as well as from their other surface active properties.

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OPEN DISCUSSION

Mr. Tisdale: You spoke of these agents acting to swell the fiber, thereby opening it up and allowing the dyestuff to penetrate. I can see where that might be all right in the case of yarn. In the case of piece goods, especially a tightly woven taffeta, if it swelled up the fiber wouldn't it also tighten it? And, if so, wouldn't that tend to form uneven dyeings?

Dr. Smith: I think what you have in mind there as to the swelling action is a little different from what I had in mind. Actually, these intercellular spaces which we want to swell up, so to speak, are the spaces which would become swollen on wetting anyway. All we really want to do is to get the yarn wet. I doubt very much if that type of swelling would reflect itself in a tightening up of the piece goods to any greater extent than you would get in the absence of surface active agents, say, after long wetting in the bath, so that you finally reached an equilibrium condition. Does that answer your question?

Mr. Tisdale: Yes, that explains it partially. I still think that where the individual fibers cross and recross in the weave there would be a tight spot, and wherever there was a tight spot, the two fibers pressing tighter against each other would resist penetration. Perhaps the swelling that you speak of is so minute that that might not in practice be a fact, that the whole cloth is really tighter than it was when it started in.

Dr. Smith: The type of swelling I had in mind wouldn't be the type which would give you a tightness in the cloth and make it impossible for you to make a dyeing. It is, rather, the normal swelling which you would get when the cloth becomes wet. That means that adding the surface active agent to the dye bath increases the rate, that is, speeds up the opening up of these pores to the ultimate condition which promotes favorable absorption of dyes.

Mr. Tisdale: That simply means, open it up to let the water get in?

Dr. Smith: Yes.

Mr. Tisdale: Because where the water gets in the dye will get in?

Dr. Smith: Yes, where the water gets in the dye will get in.

Mr. Thayer: The primary use, then, is to promote levelness, eventually, isn't it?

Dr. Smith: Yes, that is right, as well as penetration.

Mr. Thayer: Do these agents have any retarding action?

Dr. Smith: The types such as sulfated fatty alcohols, or similar types, don't have very much retarding action as far as can be observed. The oppositely charged types,

such as the cetyl pyridinium bromide, would have a strong retarding action when used in rather small quantities in solution.

Mr. Thayer: What is the optimum point where the retarding action stops and levelness increases? Couldn't that be very finely controlled?

Dr. Smith: Well, I think it is generally considered that the object of getting a retarding action in the dye bath is to keep the dye from jumping on too rapidly. In other words, it is best not to get too rapid absorption of color in practice. We ordinarily make the dyeings at the boil because we want to get a chance to level things out, and we do that by having the dye alternately go on and off the goods at the boil. Of course, anything which decreases the rate of absorption at the start will tend to promote level dyeing by the same method as this boiling on and off the goods. If the dye never goes on there to start in with, you don't have to take it off. Ultimately, of course, you do get exhaustion from the bath in the presence of the amounts of retardants which are used in dyeing processes. Otherwise, you couldn't use them.

Mr. Thayer: Salt would be put in to push it on and your agent would be put in to act as a buffer, is that right?

Dr. Smith: Yes. I think that is a way you could describe it. That is, the salt is necessary in order to get the absorption of the color, and the cetyl pyridinium bromide, as an example of that type of surface active agent, would be put in to restrain the rate at which the dye is absorbed.

It is believed by some authorities that cetyl pyridinium bromide acts as a competitor for the dyes in its absorption process on cellulose fibers, as the cetyl pyridinium bromide is actually substantive in itself, and that is the secret of the retarding action. Then you also have the fact that cetyl pyridinium bromide will tend to build up rather large aggregates with colors which are oppositely charged in solution, and that in itself is enough to slow down the rate of absorption. Of course, your surface active forces there, at the same time, are sufficient to give you uniform dyeing ultimately.

Mr. Thayer: If everything is constant except the amount of this agent used, and the amount of the agent is increased all the time, would the ultimate dyeing be weaker?

Dr. Smith: Yes, you can put in too much.

Mr. Thayer: That is the point I was getting at. Is that controlled very closely, or doesn't it make much difference whether a person has one or five per cent?

Dr. Smith: I don't think you would be able to use five times as much as the recommended quantities and get nearly as good results.

Mr. Thayer: I wondered how close in actual practice the dyer was able to measure the benefits of an agent like that.

Dr. Smith: Actually, I don't think cetyl pyridinium bromide is being used much in this country.

Mr. Thayer: Well, any agent.

Dr. Smith: Of course, the retardant which is used most widely at present I think is in the dyeing of vat colors, and that is probably glue, and the effects must be pretty good from the amount used. Of course, glue isn't as sensitive to this phenomenon that you speak of; that is, you don't have to control that as carefully as you do other surface active agents.

Mr. Ackley: Dr. Smith, in the use of these cation surface active materials, how would you explain the fact that the cellulosic materials, when treated previously with such agents, increase the adsorption very markedly? For instance, it is possible to get a relatively good waterfast dyeing with dyes like Azo Wool Violet 4B, which ordinarily would leave the rayon perfectly white.

Dr. Smith: Well, this is merely conjecture on my part, but I think it is possible that this type of agent that you speak of changes the charge on the cellulose fiber and gives it a strong positive charge, whereas your dye is strongly negatively charged in solution, and in that way promotes absorption, which otherwise wouldn't occur. You know that normally cotton, or the rayon fibers, are negatively charged in solution by virtue of their contact with water. That is a colloidal phenomenon which occurs, I believe, almost universally. Nearly all materials, when they come in contact with water, acquire a negative charge. But it might be possible, under the proper conditions, to give a positive charge to the fiber by putting on these materials that you speak of, and in that way giving affinity for dyes to which ordinarily they don't have any affinity at all.

Mr. Ackley: In regard to the anion active materials that are common surface active agents, have you encountered any specific compounds which, although good wetting agents as measured, say, by the Draves test, do not promote level dyeing? There are, I believe, a few very pronounced surface active materials which do not give level dyeings, whereas materials that are much poorer wetting agents, at the same concentration, do give level dyeings.

Dr. Smith: I don't know just what you have in mind there. I haven't run into any of those circumstances, personally.

Mr. Ackley: Wetting agents, or surface active agents, seem to fall, in regard to their wetting properties, into two classes: the wetting agent and the penetrating agent, from what I have seen. I have encountered some that are characterized by the fact that at very low concentrations, if you introduce a small piece of canvas into the bath and quickly wet over both surfaces, it would sink just below the surface, and then fail to sink, whereas other materials that are classed as poorer wetting agents will wet the swatch from the bottom and drop it. Those materials seem to be fairly good dye penetrating agents, whereas some of these very good so-called wetting agents, of which you can take a quarter of a per cent solution and drop a piece of canvas on it and have it hardly pause, are very poor dye penetrating agents.

Dr. Smith: There, of course, you get into just what

constitutes a good measurement of wetting efficiency when you bring that up. We have quite a variety of tests which are recommended in the literature. The mere fact that a piece of canvas has most of the air displaced from it and sinks just below the surface of the liquor doesn't, to my mind, mean at all that the canvas is wet out. It merely means that enough air was displaced from it so that it sank below the surface, and nothing else.

I have observed the same thing of which you speak in tests which I have had occasion to run. I have noticed quite often these canvas pieces sink, even though there is obviously a lot of air still on the surface. Well, that means that the test is largely a measure of the effectiveness of the solution in displacing air from the fibers, rather than causing penetration of water into the fibers, and of course that is what you want with the dyeing process.

Mr. Holterhoff: You mentioned the action of the retarding agents on a dyed fabric, as to how quickly they improve the dye. But have you noticed any difference as to the fastness of a dye when dyed with these various agents?

Dr. Smith: We haven't made any tests on that at all. I doubt if there would be any detectable difference. Of course, the main advantage in adding wetting agents to the dye bath is usually to assist in dyeing things which haven't been processed so that the best dyeing can be carried out; that is to say, if the dyer wants to save time in his processes, which is quite important in American textile processing, he may neglect to remove some of the fats, waxes and whatnot from the goods, and then rely on the wetting agent later on to give correct penetration into the fibers.

Mr. Holterhoff: My question was asked on the assumption that the penetrating agent will assist in giving a more uniform dyeing through the fiber, whereas you might get only a surface dyeing. I assumed a surface dyeing would be more easily removed, but have you found that actually the case in tests?

Dr. Smith: Well, I haven't run across any. In none of my work have I run across the phenomenon of surface dyeing strictly. That is, I would say that all the dyeings with which I have worked in this paper were well penetrated.

Mr. Holterhoff: Of course, that is speaking only relatively.

Dr. Smith: As I pointed out, the dyes themselves are small enough to get into the intercellular spaces, even without the addition of the surface active agents, and I think you will get a well penetrated dyeing whether or not you have a surface active agent in the bath, if you give it long enough to make the dyeing.

We haven't made tests which would be designed to show whether or not there would be any difference in the fastness of dyeings made with and without surface active agents.

Dr. Eck: Some dyers like to determine the minimum amount of dye assistant by the old method of foam. Of course, they were used to soap years ago, when they had calcium in the water and had to use a certain surplus of soap in order to emulsify the calcium soap. They still think foam is necessary. Do you think so, too?

Dr. Smith: I don't think foam is necessary in order to get good wetting. As a matter of fact, there is quite a variation in the amount of foam you get from different surface active agents, and also quite a variation in the stability of the foam which you get from surface active agents. The mere fact that a solution foams is no criterion of its wetting power. You wouldn't, for example, say that beer, which has very good foam, would necessarily make a very good wetting agent.

Dr. Lucy: I would like to ask if you consider these dyes as hydrophobic or hydrophilic colloids.

Dr. Smith: That is a point that I never considered.

Dr. Lucy: I was thinking of Wolfgang Ostwald's paper at the Colloid Symposium in Cambridge last May, where he considered the action of all electrolytes, whether they were salts or not, of any particular valence type, and said he considered that they could be explained on the basis of the particle theory from the valence type and ion size that you could consider your salt and your sodium lauryl sulfate, and so on, all in one class, really, as far as they affected the colloidal properties of any hydrophobic colloid that happened to be in suspension.

Dr. Smith: I think it possible that the sodium ions from the surface active agents may have about the same effect on the degree of aggregation of the dyes as you get from sodium ions, say, sodium chloride or sodium sulfate. Of course, you have a higher molecular weight with the surface active agents and it wouldn't be a very good way to precipitate the dye out of solution.

Mr. Ackley: The color of your solution would depend on the degree of aggregation of the dyestuff itself, would it not?

Dr. Smith: Theoretically that is correct, but it happens that under the conditions in which we measure the color the dye is very well dispersed. Actually, we used a cell which had a thickness of ten centimeters, which means that we have only a few tenths of a milligram per liter of the dye present, and we know that dyes are practically molecular solutions under those conditions.

Mr. Thayer: A moment ago I spoke of control. Is it true that you would want to use the amount of surface active agent that would open your fiber and no more, and then control the salt so that you would have the greatest rapidity of dyeing and still get levelness? Because, in one sense, your surface active agent is a buffer, and your salt is trying to push the color on. So, theoretically, wouldn't it be best to use that amount of surface active agent which is just enough to open up the fiber?

Dr. Smith: I don't know how you are going to determine just what that amount is.

Mr. Thayer: That is why I spoke a moment ago

ontrol, — of how closely you should control this amount surface active agent so you won't get too much in there retard the dyeing, and still have enough in there to open he fiber.

Dr. Smith: Actually, the surface active agents which re used in dyeing processes don't have very great re- arding action on rate of dyeing. You are speaking the other type of surface active agent, the quarternary mmonium type, for example?

Mr. Thayer: I understood that the other type also had me retarding action.

Dr. Smith: Oh, no, not to any practical extent.

Mr. Thayer: So, regardless of how much is added you ouldn't keep off any more color?

Dr. Smith: A surface active agent which has the same harge as the dye ion, that is to say, negatively charged urface active agent for a negatively charged color ion, oesn't appear to have much of a retarding effect, nothing f practical significance.

Chairman Zisman: In connection with the surface active gents you say that they help to promote levelness because ey open up the fibers and allow the dye to go into some f the inner cells. Don't you think that, in addition to hat, they also may emulsify in some way certain other oreign impurities that perhaps the scour has not com- letely removed—as in cotton, for example, certain waxes— nd thereby promote more levelness, because you haven't hose areas to obstruct the entrance of those fine dye articles?

Dr. Smith: I think that is quite right, that an emulsifying ction on the fats and gums and waxes which are present n the fibers is also of importance in the dyeing process.

Dr. Lucy: Your sodium chloride and sodium sulfate will also affect the colloidal size of the sodium lauryl ulfate, or other assistant there. Does that have any ffect on its behavior in regard to the dye present?

Dr. Smith: Well, I don't really know. The sodium ulfate and sodium chloride, of course, would be expected o have an aggregating effect on these negatively charged urface active agents. As far as I know, no measurements ave ever been made to determine just how great this ffect is.

Dr. Lucy: Does electrical conductivity tell you any- hing about these properties of the dye and dispersing gent?

Dr. Smith: We haven't made any tests with electrical onductivity because the things are rather complicated to nterpret. Diffusion measurements are rather easy to nterpret because of the rather large amount of theoretical work which has been done on diffusion measurements. here is the work of Hartley and Robinson in England nd Valka in Germany, which has demonstrated pretty ffectively just what you can tell from the diffusion con- tants. A great number of workers have tried to tell o nething about the particle size of dyes in solution from lectrical conductivity, but the treatment is rather involved and, after all is said and done, they really don't know much more than they did when they started.

Mr. Ackley: In connection with your diffusion measurements, what type of membrane did you use?

Dr. Smith: These diffusion measurements which I spoke of tonight were made by the micro diffusion method, with which you are probably familiar. There is no membrane involved in that method.

In most of our work in the laboratory in recent years (this work, incidentally, was done several years ago), we have used sintered glass porous membranes for the measurement of diffusion constants. That is the method which we like best at present because it doesn't require as much attention. You aren't so apt to get convection currents. You don't have to rely upon the operator so much. If you use the micro diffusion method, you measure the rate at which, say, a certain concentration of dye diffuses from the concentrated dye layer up into the water, and you do that by comparing color in one side of the cell against standard color in the other side of the cell. That means that the operator has to use pretty fine judgment. Actually, he has to match those boundaries in about a hundredth of a millimeter in order to get good results. By using the sintered glass membranes, you can measure your color in the dye solution by means of a spectrophotometer, and since you have a ten millimeter thickness, that is, it is possible to obtain a ten millimeter thickness or even a greater thickness, you really have much better accuracy, I think.

ONE HUNDRED AND TWENTY-FIRST COUNCIL MEETING

THE Council held its 121st meeting at the Chemists' Club in New York on Saturday morning, February 11, 1939. Present were Vice-President Duncan Ferguson, presiding; Louis A. Olney, Chairman of the Research Committee; William H. Cady and P. J. Wood, Past Presidents; Walter M. Scott, Councilor-at-Large; Henry F. Herrmann, Dexter R. Kneeland, Herbert S. Travis, and Ben Verity, representing the New York, Northern New England, Philadelphia, and Rhode Island Sections, respectively; and Harold C. Chapin, Secretary. The Secretary's report of the 120th Council meeting and balance sheet of February 4, and the Treasurer's report of January 31, were accepted.

A tellers' report from E. E. Fickett, J. H. Skinkle and the Secretary was accepted; and in accordance therewith, all officers on the printed ballot of 1938 were declared elected, and the new Constitution passed to letter ballot at the Annual Meeting was declared adopted. Letters of approval of the proposed By-Laws, published in the January 23 REPORTER, were received from W. R. Moorhouse, R. E. Rupp, A. R. Thompson, Jr., R. S. Wheeler, and Homer Whelchel. The following changes, proposed

SECRETARY'S BALANCE SHEET—FEBRUARY 4, 1939

	Applications	*Dues, Regular and Reinstate.*	*Dues, Corp. and Sustain.*	*Miscellaneous*	*Bank Charges*	*Totals*
Received by Secretary, Nov. 1, to Nov. 26, 1938.	$197.50	$4,264.25	$1,935.00	$415.31	—$.25	$6,811.81
Received by Secretary, Nov. 26, 1938, to Feb. 4, 1939	305.00	4,776.75	360.00	788.85*	—2.67	6,227.93
Total received	502.50	9,041.00	2,295.00	1,204.16	—2.92	13,039.74
Transmitted to Treasurer	477.50	8,017.00	2,170.00	1,184.36		11,848.86
Leaving to order of Secretary	25.00	1,024.00	125.00	19.80	—2.92	1,190.88

Miscellaneous Items*

Annual Meeting registrations	$486.00	Deter. Wool in Mixtures, report	.40
Year Books	127.25	Light Fastness reports	1.50
Dyed standards	31.00	Analytical Methods	.75
Launder-Ometer royalties	56.00	Dyestuff Reporters	18.65
Knitted tubing	47.40	Buttons	12.00
Crock-meter cloth	6.90		
Carbonizing reports	1.00	Total	$788.85

by Mr. Cady, were voted in the meeting. In Article V the word "entire" was inserted before the word Council; in Article X, Section 5, the words, "as provided in the Constitution," were inserted after the words, "proportionate representation"; and the position and numbering of Articles XI and XII were reversed. In Article XIII the words, "or Chapter," were inserted after the word "Section." With these amendments the By-Laws were approved and signed by those present.

A report was received from the Committee on Coordination of Standards, consisting of E. H. Killheffer, Chairman, W. D. Appel and Henry F. Herrmann. This was referred back to the Committee for further study of ways and means of executing its recommendations, and W. H. Cady and L. A. Olney were added to the Committee.

It was voted that the Association becomes an Associate member of the American Standards Association, with annual dues of $100. Friday, April 21, in Philadelphia, was approved for the next Council meeting, because of the Knitting Arts Exhibition during that week.

The following were elected to the classes of membership specified, as of thirty days from publication of applications, provided no objection be received meanwhile by the Secretary:

Active

A. E. Barrett	G. L. Joblon	N. G. Sixt
C. W. Berg	F. L. Kendall	S. B. Sklar
S. F. Bramble	B. B. Langston	A. B. Stonstrom
B. F. Burnett	H. H. Leary	J. W. Swiney
J. H. Coogan, Jr.	A. N. McFarlane	P. A. Tapis, Jr.
J. E. Cousineau	F. E. McKay	J. E. Weaver
E. A. Demuth	E. L. McLellan	C. E. Weber
M. J. Dorcas	M. W. Mueller	J. Whitworth
A. R. Goldfarb	H. V. Petelle	H. I. Wilcox
F. G. Gennusa	R. W. Pinault	E. E. Wild
H. Hardwick	A. K. Scribner	K. J. Winter
C. A. Henlein	J. H. Shipp	

Junior

R. O. Barry	D. Franceskett	L. S. Rice
O. W. Chadbourne	M. E. McKinney	J. A. Woodruff

Associate

A. B. Bullington	F. D. Jacoway	O. F. Nixon
I. Dickinson	P. A. King	T. W. Piper
B. E. Dodd	G. Mankin	S. P. Rakestraw
A. F. Fentress	L. N. Manley	W. H. Shields
C. M. Goodyear	G. F. Melville	E. L. Talman
C. J. Haas	J. M. Mozley	L. G. Tubbs
F. T. Hardwick		

Student

P. O. Anderson	M. E. Keizer	A. W. Mungall
I. M. Bethel	H. L. King, Jr.	W. A. Nelson
A. M. Campbell	A. W. Lanner	A. F. Nuttall
J. Dias	W. T. Liu	D. T. Smith
J. K. Frederick	N. J. Manning	J. F. Wessells
J. S. Gill	E. F. Maslanka	M. R. Woodard

The following were transferred from Junior to Active membership: P. P. Dubiel, E. I. Stearns, Jr., W. O. Neeb.

Respectfully submitted,

HAROLD C. CHAPIN, *Secretary.*

CALENDAR OF COMING EVENTS

Meeting, New York Section, Swiss Chalet, Rochelle Park, N. J., March 24, 1939.

* * *

Meeting, Philadelphia Section, Penn Athletic Club Philadelphia, Pa., April 21, 1939.

* * *

Meeting, South Central Section, Hotel Farragut Knoxville, Tenn., May 6, 1939.

TRADE NOTES • NEW PRODUCTS

• MARCH TEXTILE RESEARCH

The appointment by President E. H. Killheffer of W. D. Appel, chief, textile section, National Bureau of Standards, as acting-chairman of the Research Council of U. S. Institute for Textile Research, and of Edward R. Schwarz, professor of textile engineering, Massachusetts Institute of Technology, as vice-chairman are reported in the March issue of *Textile Research*. They succeed respectively W. E. Emley, chief, Organic & Fibrous Materials Division, National Bureau of Standards, and Dr. H. DeW. Smith, treasurer, A. M. Kenney Associates, resigned. Mr. Emley has served as chairman of the Council ever since the organization of the Institute in 1930, and tendered his resignation because of his belief that the Council should be headed by someone better versed than he in textile techniques now that the Institute's research work along applied lines is increasing. Dr. Smith's resignation was rendered at the last annual meeting because of increased business duties. He and Mr. Emley continue as members of the Institute with unabated interest in its work. Mr. Appel's appointment as "acting-chairman" until the next meeting of the Board of directors is due to the fact that this is an elective office and carries with it membership on the Board and the executive committee. He and Prof. Schwarz have been members of the Institute from its inception. Prof. Schwarz is a director, vice-president and member of the executive committee.

An important practical application of fundamental research based upon findings of a study of textile waste disposal and recovery is described briefly. It is the million dollar municipal sewage plant recently completed at Greensboro, N. C. The research in question has been in progress since 1932 at the University of North Carolina and a pilot plant at Greensboro, and was wholly financed by The Textile Foundation. A description of the sewage plant with particular reference to the application of the research work will be contributed to an early issue of *Textile Research* by Dr. H. G. Baity, professor of sanitary engineering, University of North Carolina, who is director of the research for The Textile Foundation.

The comparative wetting properties of raw and dewaxed silk, and the relation between the ether-soluble material (largely wax) of raw silk and properties of this fiber other than wetability are described by Werner Bergmann in a Textile Foundation research report entitled "Silk Wax and Certain Physical Properties of Raw Silk." He finds that "there exists no apparent relation between the E. S. No. and the nature, boil-off, tenacity, elongation, cohesion and resistance to friction of raw silk." He also reports that "the wetting properties of raw and dewaxed silk have been compared by means of the sinking test. It was found that in general removal of the wax reduces the sinking time from many seconds or even several minutes to a fraction of a second."

• BROWN EXHIBIT

At Booths 420-21-22, Southern Textile Exposition, Greenville, S. C., April 3-8, The Brown Instrument Company, *a division of Minneapolis-Honeywell Regulator Co.*, will feature indicating, recording and controlling instruments for the regulation of temperature, pressure, flow, humidity, liquid level, etc., in textile processes.

Featured in this exhibit is a working demonstration of slasher speed control. A photographic model of the slashing machine is equipped with the Brown Moist-O-Graph Recording Controller.

• CIBA RELEASE

The Society of Chemical Industry in Basle, represented by Ciba Co., Inc., has issued a circular describing the following new product:

Cibanone Brown GRF—a new type dyeing a purer and redder shade than the former type, Cibanone Brown GR. It is stated that this new type is noted for its very good solubility, combined with good levelling qualities, making it adaptable for use as a self color as well as in combinations with others of the Cibanone series on loose cotton, sliver, packages, beams in circulating machines, for yarns in the regular dye-vat and piece dyeing. The fastness properties are said to be exceptionally good and it may be used for yarns to be kier-boiled and bleached. Dyeing processes CII and CIII may be used. The same is said to be true of dyeings on viscose rayon but viscose of irregular affinity cannot be covered evenly. In fabrics composed of cotton and viscose rayon, the rayon will be dyed deeper than the cotton. It is stated that Cibanone Brown GRF is suitable for dyeing unweighted silk, the dyeings being fast to boil-off. Circular No. 484.

• TALK ON MOTHPROOFING

At the National Retail Dry Goods Association convention held during the week of January 15th in New York, J. L. K. Snyder of Merck & Co., presented a paper entitled "The Protection of Fabrics from Destruction by Moths." During the course of his paper Mr. Snyder discussed the specifications for an ideal mothproofing compound. He enumerated the following properties as being essential: (1) it should render animal fibers resistant to clothes moths and carpet beetles; (2) it should be substantive to animal fibers, that is, it should combine chemically with them; (3) it should not harm the animal fibers nor in any way change their physical characteristics except to improve those which are desireable; (4) it should be absolutely fast to dry cleaning; (5) it should be fast to light and to abrasion; (6) it should be reasonably fast to washing, taking into account the fabrics involved; (7) it should be odorless, non-toxic and non-allergic to humans. Mr. Snyder went on to say: "A mothproofing compound which provides all these properties is one which you can s a f e l y specify, provided the standard adopted can be maintained. And here I come to perhaps the most important feature of any mothproofing process. It is not enough to attain perfection; the standard so reached must by some means or other be maintained; so that you gentlemen can be certain that anything that purports to have been treated by a given mothproofing process actually has been so treated; that goods so treated were not released to you until they have been tested and can, therefore, be offered to the public in good faith which is the keystone of your relations with the public." Mr. Snyder then pointed out that Merck & Co. had introduced a system of distribution of their product under license in the matter of details of application, control tests, proper records and other necessary checks.

• MEETING, A. A. T. T.

A meeting of the American Association of Textile Technologists was held on February 1, 1939. Miss Esther Lyman, merchandising editor of *Harper's Bazaar*, addressed the gathering. There follows a resume of her talk:

"Yarn technicians who are making yarns for fabrics to be worn in clothes are in the fashion business. Fashion works profitably for yarn houses, weavers, converters and stores from the top down. For this reason, it would seem to be absolutely necessary to make very complete fashion research at all times. The creator of new yarns and new fabrics is building for the future and must determine acceptance in higher fashion ready-to-wear before he can expect his company to sell his creation in the volume priced lines which will absorb necessary poundage.

"From the editorial point of view

Harper's Bazaar is tremendously interested in the development of the beautiful new textures and types of fabrics which have come from the various yarn houses. We wish always to describe them accurately and to give our readers the information they should have about these fabrics.

"At the present time in dealing with realdy-to-wear, it is exceedingly difficult to get the information about fabric content which we should have and it must be just as difficult for store buyers and customers to obtain the same information. Because there are so many manufacturers involved in the making of a piece of material which eventually appears in a dress, the problem of promotion of a fabric is particularly difficult and open to a good deal of controversy. However, a company that is to establish its name and stand for fashion and quality in the eyes of the consumer must be responsible for its product in the finished state and as the consumer buys it.

We find that many store buyers do not know that the yarn manufacturers do not also make the fabrics. Should not store buyers have more information about fabrics than they are able to get at the present time? It is they who must face the customer when there is any dissatisfaction and it is they who must make the adjustments.

"There are a few common sense suggestions which, it seems to me, would be tremendously helpful to the yarn companies as well as to the stores and customers if they could be carried out:

"1. To give the buyer accurate information about yarn makers, weavers and converters. It is all very confused in the minds of most of them at the present time.

"2. To frequently arrange with the stores to put in the hands of the salespeople manuals which will discuss fabrics from the selling point of view. For instance, this season there are to be very wide circular skirts which means that no matter how good the fabric is or what its content, the circular cutting will not allow an absolutely even hemline after it has been hung and worn for some time. This is a simple fact which salespeople do not know, but should be able to pass on to their customers so that the fabric will not be held responsible for the changing of the hemline. Training departments would be delighted to have information of this sort. It should not go into technical details which do not relate to the actual selling.

"3. Dramatize the fabric and yarn, also merchandise the advertising. It would seem to me to be very helpful to customers if the quality of the fabric could be stressed in every advertisement. This means that the weaver and converter, as well as the dress manufacturer, must be checked as to the quality of construction, of dyeing and finishing and of cutting and making. The readers of the advertisement should be requested to insist upon labels giving correct data about the fabric content and the quality of the material used.

"4. Personal follow-up on the part of the various companies to be sure that their yarns are getting into quality materials and are being properly treated from start to finish and that stores are not having trouble with them. If this is being done now, which it may be, store buyers would like to know about it. Fashion and trade publications are delighted to cooperate in giving correct news and data to the trade and to the consumers and this news should be passed on to the various publications as fast as it develops."

● JOINS QUAKER

The Quaker Chemical Products Corporation of Conshohocken, Pa., wishes to announce that they have added to their laboratory staff for control and development work, Mr. James B. Jones.

Mr. Jones is a graduate of the Philadelphia Textile School and completed his chemical work at Rensselaer Polytechnic Institute. Mr. Jones previously worked for two years for the General Dyestuff Corp. in their Philadelphia office. Since then he has worked at the Eddystone Print Works, the Utica Willowvale Bleachery as Assistant Chemist and the Cold Springs Bleachery. Until recently he was with the Buffalo Electro Chemical Company doing research work on bleaching agents.

● DAYLIGHT FLUORESCENT LAMP

A new line of lighting units designed to utilize the unique lighting characteristics of the recently introduced "Daylight" White Fluorescent lamps and which are said to provide heretofore unobtainable efficiency for lighting operations requiring accurate color descrimination, has just been placed on the market by the Benjamin Electric Mfg. Company, Des Plaines, Illinois.

Known as "Daylight" Fluorescent Lamp Diffusers, these new units have numerous industrial and commercial applications. It is stated that a minimum of 100 foot-candles of daylight quality light of 6500 degrees Kelvin color temperature rating (a scientific measurement of the spectral composition of light established by the National Bureau of Standards and the International Commission on Illumination as the standard for even the most exacting color work) can be uniformly distributed over an area of 3 feet by 4 feet when a 36-inch lamp unit is suspended 30 to 36 inches above the surface; a proportionally lower intensity over a relatively smaller area is provided by the 18-inch lamp unit.

Moreover, this "daylight" illumination is said to be produced without the usual absorption necessary for correction of incandescent "daylight" units.

As an example of "daylight" lighting efficiency, the three 36-inch lamps consuming with auxiliaries approximately 105 watts and provide 3240 lumens of 6500 degrees Kelvin light. A 1000-watt (20,050 lumen) incandescent lamp corrected to 6500 degrees Kelvin would have an absorption of about 8 per cent or a corrected lumen output of 2400 lumens—less by 840 lumens than the output of the "Daylight" Fluorescent Lamp Diffuser.

The low surface brightness of the lamps (in the order of 3 candles per square inch) and practical absence of radiated heat are said to permit location of lighting units low over the working plane, and even in the direct line of vision without discomfort.

● MATHIESON EXHIBIT

The Mathieson Alkali Works, Inc., 40 East 42nd Street, New York City, will occupy booth numbers 469-470 at the Southern Textile Exposition to be held in Textile Hall, Greenville, S. C., April 3rd to 8th. Products shown will be caustic soda, soda ash, bicarbonate of soda, liquid chlorine, ammonia and H T H (calcium hypochlorite). The southern district sales office of this company is located in the First National Bank Bldg., Charlotte, N. C. Resident headquarters during the show will be at the Poinsett Hotel.

● REFLECTOMETER

Pfaltz & Bauer, Inc., Empire State Bldg., New York City, offer a new University Model Photo-Electric Reflectometer known as Model M. U. This instrument in accuracy and adaptability with other photoelectric measuring accessories is said to be of invaluable aid in measurements of sugar, starch, pencil lead, paper, fabrics, limestone, food, cosmetic powders, etc., where determination of very minute differences in shade is of importance.

Through the use of color filters, the model may be used for determining the shades of colored specimens according to C. I. E. standards.

For fabric testing, special rings and mountings are available which hold the fabric tightly, thus assuring a smooth surface during measurements. For series analysis multiple cuvettes are available.

Detailed literature on this new instrument will be furnished upon request.

● FIXANOL PREPARATIONS

Pfaltz & Bauer, Inc., Empire State Bldg., New York City, offer new literature

scribing DeHaen's Fixanal Preparations for Standard solutions. Fixanal Preparations are correctly weighed and standardized analytical chemicals, packaged in a unique manner, which when diluted according to directions produce accurate volumetric solutions ready for instant use. Accuracy certified to be within 2 parts per 1000. Special normalties are available for special purposes. Copies will be furnished upon request.

• USS EXHIBIT

The joint display in spaces 455 and 456, featuring products of the United States Steel Corporation subsidiaries at the Southern Textile Exposition, April 3-8, will call particular attention to the increasing use of stainless steel in the textile industry. Cooperating in this exhibit will be the American Bridge Company, American Steel & Wire Company, Carnegie-Illinois Steel Corporation, Columbia Steel Company, National Tube Company, and Scully Steel Products Company.

Stainless steel tubing and other forms of this gleaming, corrosion resistant and high strength metal will be featured, one exhibit being a cut-away section of a stainless steel heat exchanger. Mechanical tubing, Duroline, seamless steel boiler tubing, and copper steel tubing will be shown, with exhibits of the roofing and siding sheets so widely used in the industry.

• OFFICERS, LAVANBURG CO.

At a recent meeting of the Board of Directors of the Fred. L. Lavanburg Company, the following officers were elected.

President.....Henry Reichhold
Executive Vice-President and Gen. Mgr.
Richard Katz, Jr.
Secretary .....Eugene A. Terray
Treasurer.....S. H. Baum
Vice-President, in charge of sales
Selden G. Hait
Vice-President, in charge of production
Austin J. Farrey
Vice-President.....J. H. Ebert

Mr. Reichhold comes from a European family of dry color makers, and his earliest experience in the chemical industry was in this particular branch of raw materials.

Messrs. Hait, Ferrey and Ebert have been with the Lavanburg Company for over 25 years, and have spent all of their business experience in the chemical color industry.

Mr. Hait's sales activities have extended to all parts of the country, and he is well known throughout the trade, whereas Mr. Ebert's efforts have been centralized mainly in the metropolitan New York area and the eastern Atlantic Seaboard.

Mr. Farrey has been with the Lavanburg Company since 1894, and is generally recognized as one of the authorities in the manufacture of dry colors.

Mr. Richard Katz, Jr. is the grandson of Mr. Adolph B. Ansbacher, the oldest manufacturer of chemical pigment colors in this country. Prior to his affiliation with Reichhold Chemicals in 1937 he was actively engaged in the production and sales of chemical pigment colors for many years.

• STYLE SHOW

Nine colleges for women in North Carolina will be represented by contestants in the 12th annual style show at State College April 20, Dean Thomas Nelson of the Textile School, which sponsors the style show and exposition, announced recently.

Dean Nelson said 115 college girls, students in home economics, would model clothing made by themselves from materials designed and woven by students in the Textile School at State College. The girls will make the costumes as part of their regular classwork.

Participating colleges, and the teachers of home economics in charge of the project, are: Elon, Miss Lida Muse; Flora Macdonald, Miss Thelma M. Hall; Greensboro, Miss Bernice J. White; Queens Chicora, Mrs. Guy Eason; High Point, Miss Lola Barry; Louisburg, Mrs. I. D. Moon; Meredith, Miss Jennie Hanyen; St. Mary's, Miss Elizabeth Bason; Peace, Miss Bertie Lee Whitesides.

• JOINS A. A. P.

Joseph T. Bohannon, formerly with International Salt Company, is now employed by the American Aniline Products, Inc., Charlotte, North Carolina. Mr. Bohannon is a former resident of Grantville, Ga., and a textile chemist from Alabama Polytechnic Inst. in 1937.

• RESEARCH CONFERENCE

Scientific research workers on the staff of the Textile Foundation and members of the Foundation's Advisory Committee for Scientific Research have just completed a conference at the National Bureau of Standards, Department of Commerce, in Washington.

Joining the group of twelve from the Washington laboratories were representatives of projects under way at the University of North Carolina, Massachusetts Institute of Technology, Yale University, and the Lowell Textile Institute.

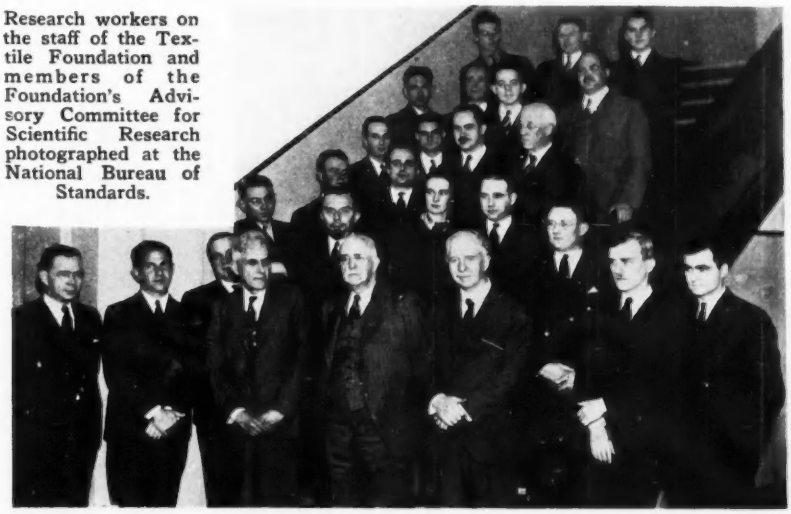
It is already evident that a greater understanding and closer coordination of the research activities of the Foundation have resulted from the conference and that administratively the work will move along with even more effectiveness, it was stated.

The Foundation, it will be recalled, was organized for scientific and economic research for the benefit and development of the textile industry, its allied branches, including that of production of raw materials.

Franklin W. Hobbs, Chairman of the Board of Directors, attended the conference which was presided over by Dr. Robert E. Rose, chairman of the Advisory Committee for Scientific Research. Other members of the committee present were Alban Eavenson, Warren E. Elmey, Harold DeW. Smith, E. R. Schwarz, Hugh S. Taylor and R. Y. Winters.

• STEIN, HALL EXHIBIT

Stein, Hall & Co., Inc., 285 Madison Ave., New York City, will feature their laboratory facilities at the Southern Textile Exposition, to be held April 3rd to 8th, at Greenville, S. C. They will occupy spaces 467-469 Annex. They will have a special dark room in which will be set up the special ultra-violet ray apparatus which their laboratory uses to irradiate starches, gums and finishes. With this apparatus it can clearly be seen the difference between fabrics printed with the same design, but with different gums and compounds.



Research workers on the staff of the Textile Foundation and members of the Foundation's Advisory Committee for Scientific Research photographed at the National Bureau of Standards.

• ARMCO EXHIBIT

Visitors at the Southern Textile Exposition at Greenville, S. C., April 3 to 8, will view an interesting exhibit of stainless steel equipment—some miniature, some life-size—sponsored by the American Rolling Mill Co., Middletown, Ohio. The suitability of Armco stainless steels for many kinds of textile equipment will be illustrated in the exhibit, which will occupy Booth No. 102.

• NEW BICK OFFICE

Bick & Co., Inc., who have been engaged in the manufacture of chemicals and dyestuffs since 1916, announce the opening of a Southern office and laboratory at the corner of Tryon and Third Streets, Charlotte, N. C. This should prove of interest to their many customers in North and South Carolina, especially as it will facilitate technical service. Mr. Louis A. Gregg, who is well known in the Carolinas, will be in charge. Complete stocks are being carried in Charlotte as well as in High Point, N. C.

• APPOINTED SUPERINTENDENT

James Dolphin of Maryville, New Brunswick, a graduate of North Carolina State College Textile School, has been appointed superintendent of the Ontario Mills, Canadian Cottons, Ltd., Hamilton, Ontario, Canada.

• APPOINTED INSPECTOR

Glenn Penland, who graduated from the Textile School of North Carolina State College, has been appointed inspector of the State Department of Labor in Charlotte, North Carolina.

• BLICKMAN EXHIBIT

S. Blickman, Inc., Weehawken, N. J. will occupy spaces 317 and 318 at the Southern Textile Exposition to be held April 3rd to 8th in Greenville, S. C. They will exhibit a line of stainless steel equipment for the textile wet processing industry, including a full size dye jig and a model of a stainless steel dye beck in operation.

• ONYX EXHIBIT

Onyx Oil & Chemical Co., Jersey City, N. J., will exhibit at the Southern Textile Exposition in Greenville, S. C., April 3rd to 8th, occupying booth number 218. On display will be samples of their processing and finishing compounds for hosiery and underwear, together with exhibits of fabrics showing effects achieved.

• GENERAL RELEASES

General Dyestuff Corp., 435 Hudson St., New York City, announces release of a circular describing the following product:

Diazo Fast Red 8 B L—which, when diazotized and developed with Developer A, produces clear, bluish red shades said to be of good fastness properties. The product is particularly recommended by the manufacturers for its very good dischargeability with neutral and alkaline discharge paste. It is also said to be well suited for mixed fabrics of cotton and viscose, giving very good tone-in-tone effects. It is further said to be well suited for the dyeing of silk from a weak acetic acid bath. Circular number 1589.

Chromoxane Brilliant Violet 5 R—a new homogeneous chrome dyestuff of a particularly bright shade, said to have a comparatively good fastness to light. The product is said to level well and to yield bright clear lilac shades of good fastness to washing, milling, carbonizing and decatizing. Circular No. 1614.

Nullapon A and *Nullapon B*—two organic water softeners. It is stated that these products not only prevent the formation of lime soap but also re-dissolve lime soap and difficulty soluble compounds of metal soaps, carbonates and hydroxides precipitated on the fiber. In addition to this, Nullapon B is especially used for the removal of copper or manganese from material to be vulcanized and for clearing the yellowish tint caused by iron on white goods. Circulars 1608 and 1609.

• ELECTED DIRECTOR

H. R. Tisdale, well known sales manager of the American Dyewood Company, was elected a director of that organization on February 21st.

• REPRINTS, NAPHTHOL AS DYES

Reprints of the article entitled "Chemical Constitution of the Naphthol AS Type Dyes" by Kenneth L. Dorman which appeared in our issue of February 20th are available at 25 cents each.

CLASSIFIED

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

POSITION WANTED: Colorist and Chemist, 11 years' laboratory experience. Thorough knowledge of dye testing and matching. Capable of taking charge of laboratory. 30 years of age. Married. Will go anywhere. Write Box No. 170, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: COLOR CHEMIST. Twelve years' laboratory and plant experience. Research, Sales, Executive, and Production Ability. Well versed in Dyestuffs, Cellulose Derivatives, and Synthetic Resins. Available immediately. Write Box No. 174, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

GESUCHT

DRUCKEREI-KOLORIST

schweizerischer Nationalität, Akademiker bevorzugt, mit vieljähriger Praxis auf dem ganzen Gebiet des Zeugdruckes. Sprachgewandt in Deutsch, Französisch, Englisch. Anmeldungen mit Lebenslauf, Zeugnisabschriften und Referenzen an Chiffre. . . . Write Box No. 175, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED: Textile Chemist—Recent Graduate with one or two years' experience in Printing and Finishing plants. Kindly list training and experience in detail and enclose recent photograph. Write Box No. 176, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED: Experienced chemist or colorist for laboratory matching direct developed indanthrene colors on rayon skeins. State fully, age, salary and experience. Write Box No. 177, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.